Centripetal Force and Centrifugal Force in PPC Gravity

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Abstract

This paper develops a pressure-based interpretation of centripetal and centrifugal forces within the PPC Law of Gravity. In this framework, gravitational behavior arises from pressure generated by local energy density, and curvature emerges from the distribution of this pressure throughout spacetime. Centripetal force is described as the inward component of the gravitational pressure field that maintains curved geodesic motion. In contrast, centrifugal force is interpreted as the outward inertial response of matter resisting curvature imposed by the pressure field. Together, these two forces describe the dynamic balance between inward pressure-driven curvature and outward inertial tendencies in rotating systems, including spherical planets and orbiting bodies. This work establishes a unified physical and geometric explanation of rotational dynamics that extends traditional gravity models and integrates seamlessly with PPC theory.

1. Introduction

Conventional physics describes centripetal force as the inward force required to sustain circular motion, while centrifugal force is usually treated as an apparent outward force experienced in a rotating frame. Although these concepts are well understood in Newtonian mechanics, their deeper origin within gravitational theory remains unclear.

The PPC Law of Gravity transforms the understanding of gravitational and rotational dynamics by linking curvature directly to gravitational pressure. In PPC, energy density generates pressure, pressure generates forces, and forces shape the curvature of spacetime. Within this framework, centripetal and centrifugal forces arise naturally as manifestations of the gravitational pressure field and inertial response.

This paper develops a complete PPC interpretation of both forces, applicable to rotating planets, orbital motion, and any curved geodesic environment.

2. Foundations of the PPC Law of Gravity

The PPC Law is based on three central principles:

1. Energy Density Produces Gravitational Pressure
Gravitational pressure equals local energy density, establishing pressure as the physical cause of curvature.

2. Pressure Generates Forces
Pressure gradients produce field forces, while pressure acting across finite areas produces surface forces.

3. Forces Shape Curvature and Motion
Curved geodesics are the result of inward pressure forces balancing inertial tendencies.

These principles form the foundation for interpreting centripetal and centrifugal forces in PPC gravity.

3. The Nature of Centripetal Force

3.1 Classical Perspective

Classically, centripetal force is the force directing an object toward the center of rotation, enabling circular motion. Examples include gravity holding planets in orbit or tension in a rotating string.

However, classical physics does not explain why this force must exist beyond geometric requirements.

3.2 PPC Interpretation

In the PPC framework:

Centripetal force is the inward gravitational pressure force required to maintain curved geodesic motion.

It arises from two components:

A. Field Force (Pressure Gradient Force)

The gravitational pressure field is stronger toward the center of mass.
Its gradient creates a continuous inward pull.

B. Surface Force (Curvature Pressure on Matter Layers)

In spherical planets and stars, pressure acts inward on each layer of matter, supplying structural centripetal support.

Together, these forces form the complete PPC centripetal force.

3.3 Centripetal Force as a Curvature-Maintaining Pressure

Objects follow curved geodesics because they move along the geometry shaped by gravitational pressure. Maintaining this curvature requires an inward pressure effect to balance the tendency of matter to travel in a straight line.

Thus, centripetal force physically expresses:

inward pressure,

inward curvature,

inward stabilization of motion.

4. The Nature of Centrifugal Force

4.1 Classical Perspective

Centrifugal force is traditionally considered a fictitious force experienced in rotating reference frames, appearing to push objects outward.

4.2 PPC Interpretation

PPC provides a deeper physical explanation:

Centrifugal force is the outward inertial resistance of matter against the curvature imposed by the gravitational pressure field.

It is not a physical push; it is the natural consequence of inertia attempting to follow a straight path while the pressure field guides motion along a curve.

4.3 Interaction With Curvature

Centrifugal effects are strongest where:

rotational velocity is highest,

curvature radius is largest,

inward pressure gradients are weakest compared to inertial tendency.

This is why centrifugal effects are prominent at the equator of a rotating planet but vanish at the poles.

5. Centripetal–Centrifugal Balance in Spherical Planets

In rotating spherical bodies such as planets:

Inward Forces (PPC Centripetal):

inward gravitational pressure

pressure gradients

curvature pressure

structural stresses in solid layers

Outward Effects (PPC Centrifugal):

inertial resistance to curvature

rotational kinematics

geometric radius differences by latitude

The result is a dynamic equilibrium:

At the equator: centrifugal effect reduces effective gravity.

At the poles: centrifugal effect vanishes; centripetal pressure dominates.

Planet becomes oblate due to this balance.

6. Curvature as the Mediator Between Both Forces

PPC views curvature not as an abstract geometry but as a physical outcome of gravitational pressure. The interplay is:

Centripetal force maintains curvature by supplying inward pressure.

Centrifugal force challenges curvature through outward inertia.

The shape and stability of planetary bodies and orbital paths emerge from this competition.

7. Applications of PPC Centripetal and Centrifugal Dynamics

7.1 Planetary Shapes

Equatorial bulging results from the competition between inward pressure and outward inertia.

7.2 Orbital Motion

Orbiting bodies experience a perfect PPC balance between inward pressure-based centripetal force and outward inertial centrifugal effect.

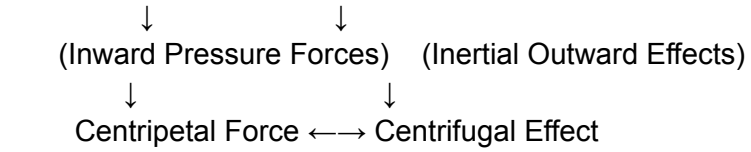
7.3 Stellar Structure

In stars, inward pressure and outward thermal motion form a centripetal–centrifugal equilibrium that stabilizes structure.

7.4 Atmospheric and Oceanic Dynamics

Rotation-driven centrifugal effects modify pressure distributions in planetary fluids.

8. Conceptual Diagram


Energy Density → Gravitational Pressure → Curvature
(Inward Pressure Forces)
(Inertial Outward Effects)
Centripetal Force ←→ Centrifugal Effect

This diagram shows the PPC symmetry:
Pressures shape curvature; inertia resists curvature.

9. Conclusion

In PPC gravity, centripetal and centrifugal forces are not independent forces but emergent phenomena arising from the interaction between gravitational pressure and inertia. Centripetal force is the inward action of the pressure field that maintains curved motion, while centrifugal force is the outward response of matter resisting that curvature. This unified description offers deeper insight into rotational dynamics and bridges the gap between classical motion and pressure-driven curvature in gravitational theory.

10. References

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